

# DIVERSITY AND DISTRIBUTION OF PTERIDOPHYTES IN SANJAY GANDHI NATIONAL PARK, MUMBAI: AN ECOLOGICAL ASSESSMENT

---

**Smt. Jayshree Shivaji Gaikwad**

Research Scholar

Shri Jagdishprasad Jhabarmal Tibrewala University

**Dr. Dinesh Kumar Singh**

Professor in Botany, Dept. Botany

Shri Jagdishprasad Jhabarmal Tibrewala University

---

## Abstract

*It is a prominent urban biodiversity hotspot that provides a refuge for a variety of flora and wildlife, including pteridophytes, which are ferns and their associates. Sanjay Gandhi National Park (SGNP) is located in Mumbai, India. Pteridophytes are extremely important to the ecological functioning of forest ecosystems because they contribute to the cycling of nutrients, the production of soil, and the provision of habitat for a wide variety of creatures. These ancient plants are frequently underrepresented in biodiversity surveys, particularly in urban protected areas, despite the fact that they contribute significantly to species diversity. The purpose of this research is to characterize the variety and distribution of pteridophytes inside SGNP, as well as to investigate the ecological parameters that influence their existence. For the purpose of collecting and identifying pteridophyte species, extensive field surveys were carried out in a variety of habitats within the park. These habitats included bamboo groves, semi-evergreen forests, and wet deciduous woods. There is a significant amount of pteridophyte variety in SGNP, as indicated by the findings, with the distribution patterns of species being strongly connected to the features of the habitat and the microclimatic conditions. The findings of this study give baseline data on the variety and distribution of pteridophytes, showing the ecological relevance of these plants in the process of preserving the health and biodiversity of SGNP for future generations. The implications of these findings highlight the significance of preserving pteridophytes and the environments in which they live within urban ecosystems. This work makes a significant contribution to a more comprehensive knowledge of urban biodiversity and highlights the importance of implementing conservation policies that are specifically aimed to maintain the distinctive flora of SGNP.*

**Keywords:** Pteridophytes, SGNP, Ecological parameter

## Introduction

Sanjay Gandhi National Park (SGNP), which is located near the busy metropolis of Mumbai in India, is a biodiversity hotspot that is home to a diverse collection of flora and wildlife. In the middle of the urban expansion, this protected area, which encompasses around 104 square kilometers, is a verdant haven that offers essential ecosystem services and functions as an essential lung for the metropolis. Furthermore, pteridophytes, which are more popularly known as ferns and their relatives, retain an important ecological

and evolutionary role among the vast biological riches that they possess. These long-lived plants, which have been flourishing since the Devonian period, are extremely important to the ecology of forests because they contribute to the recycling of nutrients, the development of soil, and the provision of habitat for a wide variety of creatures. Despite the fact that they are ecologically significant, pteridophytes are frequently neglected in studies of biodiversity, particularly in urban protected areas such as the Singapore National Park. The purpose of this ecological evaluation is to address this gap by recording the variety of pteridophytes that are found inside the park while also determining their distribution. By gaining an understanding of the diversity of pteridophytes and the patterns of their distribution, one may get insights into the state of the ecosystem and acquire information that might influence conservation initiatives. In conjunction with the tropical environment, the diversified topography of SGNP, which includes both low-lying parts and hilly terrains, results in the creation of a wide variety of microhabitats that are suited for a wide variety of pteridophyte species. A rich pteridophyte flora is supported by the park's diversified vegetation, which includes wet deciduous woods, semi-evergreen forests, and bamboo groves. This further contributes to the variability of the ecosystem. For the purpose of this study, extensive field surveys and the identification of pteridophyte species are being conducted throughout a variety of environments inside SGNP. One of our goals is to evaluate the ecological variables that have an effect on the diversity of pteridophytes by conducting an analysis of the species composition and distribution patterns. Furthermore, the findings of this study not only add to the current body of information regarding the biodiversity of SGNP, but they also highlight the significance of preserving pteridophytes and the habitats in which they live within urban ecosystems.

### **Sanjay Gandhi National Park**

When it was first established, Borivali National Park was once known as Sanjay Gandhi National Park (SGNP), which is a protected area that is reasonably large and has a wide range of animal species. Within the city of Mumbai, which is situated in the Indian state of Maharashtra, it can be found in the northern suburbs of the city. Mumbai is a city that can be found in the western region of India. The territory of the region comprises 104 square kilometers, which is comparable to 40 square miles, and it is surrounded on three sides by the metropolitan area that has the highest population density in terms of population in India. Not only is it one of the most well-known parks in the world, but it is also one of the largest national parks in Asia that is situated within a city, making it a really remarkable and unique park. Because of this, it is a particularly appealing travelling location.

More than two million people visit Sanjay Gandhi National Park every year due to the park's extensive biodiversity, which encompasses a wide variety of plants and fauna. The park was named after Gandhi, which is the reason for this particular circumstance. The Kanheri caves, which are carved out of the granite cliffs that are located inside the park boundaries, are another famous site for travelers. These caverns date back to the year 2400 and are located within the grounds of the park. Caverns like this can be found inside the bounds of the park territory.

Because of the park's "natural environment," visitors commonly choose to retreat to the undulating green fields of Sanjay Gandhi National Park in order to engage in tranquil times of thought or meditation. This is because the park is a natural environment. The reason for this is that the park is situated in a natural setting. Not only are the wide vistas of open spaces, hills, valleys, lakes, and woods beneficial to the mind, body, and soul, but they also bring therapeutic advantages to the environment in which they are situated.

## History

There is a lengthy and illustrious history that has been chronicled for the region that is now known as Sanjay Gandhi National Park. In spite of the fact that it goes back to the fourth century B.C., this history has been handed down from generation to generation. During the time that ancient India existed, there were two ports that were located in close proximity to one another. These ports were known as Sopara and Kalyan. In addition to the ancient societies of Mesopotamia and Greece, they also participated in trade contact with other ancient communities. The length of the land route that connected these two ports was forty-five kilometers (28 miles), and this forest was a section of the land route.

Buddhist monks were responsible for the creation of the Kanheri Caves, which are located in the middle of the park. These caves were constructed between the ninth and first centuries before the common era (BCE). It was envisioned that these structures would serve as both a notable Buddhist study center and a destination of pilgrimage. Both of these functions were supposed to be accomplished. It was a massive basaltic rock protrusion that served as their point of origin, and they were separated from the rock throughout their formation.

The park was once referred to as "Krishnagiri National Park" before India officially gained its freedom. At that time, the park had a total area of just 20.26 square kilometers, which is comparable to 7.82 square miles of land. In 1969, a significant number of reserve forest holdings that surround the park were bought, which led to the park being enlarged to its current shape. This process was successful in expanding the park. As a consequence of this and other factors, the park was able to arrive at its current location. Following the occurrence of this tragedy, the management of the territory was delegated to a unique entity with the name "Borivali National Park Sub-division" that is part of the Forest Department. Since its founding in 1974, Krishnagiri National Park has been renamed "Borivali National Park." This change occurred after the park was established. It was after the park had already been constructed that this alteration took place. Sanjay Gandhi, who was the son of Indira Gandhi, the former Prime Minister of India, passed away as a consequence of an aviation accident in the year 1980. Sanjay Gandhi was the son of Indira Gandhi. The park was given the name "Sanjay Gandhi National Park" in 1981, and it was named after him in appreciation of his contributions to the world. There was a boy named Sanjay Gandhi who was born to his mother, Indira Gandhi, but he did not survive.

## REVIEW OF LITERATURE

**Nitesh Joshi (2016)**, Among the many plant species included in the SGNP are many with important economic, gastronomic, and medical uses. The Red Data Book has classified them as endemic, uncommon, or endangered due to over-collection. The objective was to ensure that all floristic components were sufficiently represented, hence seasonal floristic surveys were carried out every two weeks. In order to gather knowledge on the components' significance as food, medicine, and goods, we also surveyed the local community and the SGNP Nature knowledge Center. Twenty climber species from eleven families, seventeen shrub species from eight families, twenty tree species from two hundred families, three bamboo species from one family, one epiphyte species, one parasite species, and four palm species were all found during the course of the study. Of the 84 known species of trees, 81 were found to have some sort of intrinsic value as a food source, fuel source, medicinal herb, or all three. Among the 79 plant species

identified, 66 were valuable in and of themselves and were used by the locals to generate natural revenue. Because of their significance to the area, six of the 84 tree species were listed as uncommon, endemic, endangered, or vulnerable. To a similar extent, the Red Data List classifies at least six distinct species of wild plants. Humans benefit greatly from the many different commodities and services provided by the plant species present in the SGNP. This much is apparent. The forests are a valuable asset with the ability to enhance the quality of life for countless individuals throughout the globe. The special qualities they have make them ideal for use in cooking, medicine, and commerce.

**Ambika Joshi (2014)**, In order to assess the floristic variety of Sanjay Gandhi National Park, this study will calculate the variety Indices of two distinct locations. Locations A and B, correspondingly, are the untouched Shilonda Trail and the affected Main Road going to Kanheri Caves. The study also intends to learn how the Floristic Diversity of the locations surveyed changes throughout the monsoon season by using the Shannon-Weiner Index and Simpson's reciprocal index. To achieve this, we shall examine the numerical outcomes of the calculations. Site A has a Simpson's Reciprocal Index of 25.04 and Site B a Shannon-Weiner Index of 30.2537. Calculations were used to get these values. Diversity at Site B was determined to be 40.253 according to the Shannon-Weiner Index and 29.82 according to the Simpson's Reciprocal Index. Researchers found that three plant species that are considered endangered or vulnerable by the International Union for the Conservation of Nature's Red Data List call the Shilonda Trail home. *Gloriosasuperba* L., *Dipcadisaxorum* Blatt., and *Chlorophytumborivilianum* Santapau & R.R. Fern. are among these species. Some examples of endemic and endangered species found in Site B are *Gloriosasuperba* L., *Dipcadisaxorum* Blatt., and *Chlorophytumborivilianum* Santapau & R.R. Fern. But even though there are certain species that don't exist anywhere else in the complete environment, we can still say that both areas have high Diversity Indices.

**Mayur Nandikar (2018)**, Despite its location in the middle of Mumbai's concrete jungle, Sanjay Gandhi National Park (SGNP) is undeniably a floral paradise and habitat to hundreds of species of animals. The park became one of the most visited in the world due to its beautiful weather, diverse species, and variety of plants and animals, as well as the possibility for researchers, hikers, and nature lovers to explore the forest and all its ecosystems. Mangroves, basalt plateaus, grasslands, and coastal swamp vegetation are just a few of the many habitats that surround South Georgia National Park (SGNP), which is home to an abundance of plant life. Numerous Indian and colonial botanists, including Blatter, McCann, J.F.D. Almeida, T.S. Sabnis, F. Hall, H. Santapau, R.B. Das, A.J. Randeria, R.R. Fernadez, P.S. Herbert, G.L. Shah, M.R. Almeida, and S.G. Pradhan, have meticulously studied the flora of the SGNP, recording around 1300 species of flowering plants spread out over 104 square kilometers. India is home to over 130 kinds of native plants and animals. In addition, several species, such as *Hygrophilla anomala*, *Dipcadisaxorum*, *Bhideaburnsiana*, *Ipomea salsettensis*, and *Chlorophytumborivilianum*, are only found in the SGNP and its immediate vicinity. Despite extensive research and counting of the SGNP's flora, the status of endemic species is consistently overlooked, and our understanding of their prevalence is still incomplete. Most endemic taxa are already on the IUCN's list of species that are either very fragile or endangered. Therefore, documenting these species is crucial, as it helps with conservation planning and prioritization. The study of local flora and fauna's adaptive evolution, vicariance, centers of speciation, extinction hotspots, and biogeography has traditionally benefited from endemic species. In our endeavor to document endemic plants from the northern Western Ghats, we have focused on the SGNP endemic plants on this page. In our ongoing endeavor to record endemic, this page is included.

**Aninda Mandal (2023)** The northeastern part of West Bengal, particularly the Cooch Behar area, is home to a pteridophytic plant community. From January 2021 through September 2022, researchers in the present field study documented the district's epiphytic pteridophyte flora in an effort to document its ethnomedicinal uses. Methods that had not been explored before were used to implement these applications. A total of nine species of epiphytic pteridophytes were positively identified, representing three families and six genera. Seven of these species, or four from the *Pyrrosia* genus, are found to be members of the most prestigious family in plant science, the Polypodiaceae. Ethnic groups and traditional healers used seven different kinds of epiphytes to treat ten different diseases, including the common cold, jaundice, coughs, and other respiratory infections. By naming five previously unknown epiphytic pteridophyte species, this research adds to the growing body of knowledge on the Cooch Behar District. The Cooch Behar District is home to these species.

**Sachin Patil (2017)** This article's goal is to profile all the pteridophytes found in the Northern Western Ghats of India in terms of how often they appear. This category contains 116 different species of pteridophytes. One hundred and thirty-one families and fifty genera make up this group of pteridophytes. Collectively, these six genera house fourteen distinct species that make up the fern family. With a total of nine species, *Bolbitis* is the biggest genus. *Asplenium*, *Cyclosorus*, and *Tectaria* are the next largest with four species each. *Athyrium*, *Aleuritopteris*, *Pteris*, *Ophioglossum*, and *Isoetes* are the next biggest genera in terms of species diversity, with five, four, eight, and six species, respectively.

**M. S. Arjun (2021)**, In an effort to catalog the many fern species present in the Western Ghats' Eravikulam National Park's damaged Rajamala area The Research Design: The research area employed an intended sampling method to investigate environments that were beneficial to ferns. Rajamala, a tourist-impacted neighborhood within Kerala's Eravikulam National Park, is where the study region is located. Also, the study lasts for a whole year. A substantial amount of fieldwork was conducted from February 2018 to April 2019 to document the ferns and fern-allies present in this region. This article's number. The 29th AJEE.70977 Publication Date: 2021, Volume 15, Issue 4, Pages 28-36, American Journal of Electrical Engineering In February of 2018, a pilot research was carried out to identify possible fern habitats in preparation for a full-scale exploration of the topic. The study region was sampled in a targeted manner, taking into account the most suitable habitats in the local grassland and shola ecosystems. The herbaria's processing was done in accordance with industry standards. Using botanical and common field guides, the gathered plants were identified. Furthermore, a compilation of ferns that show promise as medicinal herbs was also provided. The Rajamala section of Eravikulam National Park was discovered to be home to 54 species of pteridophytes, which includes ferns and their relatives. A total of sixteen families were established for these specific species. There were 11 species in the *Aspleniaceae* family, making it the most common, followed by 11 species in the *Polypodiaceae* family. The vast majority of the pteridophytes in this area inhabit terrestrial habitats. Eleven of the eleven species identified as inhabiting the research region have significant medicinal value. The Rajamala region of the Western Ghats has a broader diversity of pteridophyte species than other places, even though the research area is heavily impacted by tourists. This area may be home to a greater variety of pteridophytes due to its ideal habitat, year-round substrate moisture availability, and other favorable environmental factors.

**Deepa J (2013)** In the heart of the Western Ghats is the Bhadra wildlife sanctuary, where you'll find the Kemmangundi Forest. The pteridophytic composition of the Kemmangundi Forest was the subject of a



study that spanned from 2009 to 2012. This study's results show that out of 38 taxa included in the checklist, with diversity indices for 29 terrestrial species, 5 epiphytic species, 1 climber species, and 6 lithophytes from 18 distinct families. Eight species of Pteridaceae—the most abundant family in the study area—make up the family tree. After that, there are three families of aspleniaceae and Adiantaceae, each with three species, and the Polypodiaceae, which has five species. The area under inquiry is home to eight distinct species of Pteris, making it the most abundant genus. *Tectariacoudunata* (Wall.ex Hook. & ex Grev.) C.Chr., *Odontosoriatenuifolia* (Lam.) J.Sm., *Pterisbiaurita* L., *Arachniodesledgei* Fraser-Jenk., and *Thelypteriscaudipinna* are the species that follow in order of precedence. Ching has the highest potential value index for significance and is also the most densely populated place in the study region. To illustrate the abundance of pteridophytes in the Kemmangundi forest, two indicators are Simpson's diversity ( $D$ ) = 0.269 and Shannon's diversity index value ( $H1$ ) 2.97 for pteridophytic species. These two numbers are out of this world. Many researchers will find this extensive analysis of the composition-focused pteridophyte diversity and distribution in the Kemmangundi forest to be an invaluable resource for their work in the field and a solid foundation for their conservation efforts. The diversity index, Kemmangundi woodlands, and pteridophytes are among the important terms.

### Objectives of the research

1. To estimate the density of Pteridophytes in Sanjay Gandhi National Park.
2. To find out Rare and endangered taxa in pteridophytes
3. Information on traditional, indigenous, ethnomedicinal, ethanobotanical and other uses of pteridophytes.

### Materials and Methods

The objective of the study was to observe and document the changes that took place in locations that were either disturbed or undisturbed during the course of the study's duration. The principal approaches that were utilized in the process of studying the flora of the park were frequent visits to the study area and the documentation of species. It was decided to go on field excursions every two weeks throughout the year in order to gather sufficient data and obtain a comprehensive representation of the park's floral components. This was done in order to fulfill the aim of collecting adequate data. Changes in the biota were seen during the monsoon season, which runs from June to August, after the monsoon season, which runs from October to November, and during the winter season, which runs from January to March. With the assistance of the Bombay Natural History Society (BNHS), the Agharkar Research Institute (Pune), and Blatter Herbaria, the flora and wildlife that were observed over various seasonal time frames were documented and classified. This was done in order to investigate the seasonal fluctuations in the park's biotic richness. Additionally, references were obtained from the Flora of Maharashtra (Almeida M.R., 2001–2009) and The Flora of the Presidency of Bombay (Cooke T., 1901–1908). Both of these botanical works were consulted. Locals of the SGNP were contacted in order to acquire a comprehensive understanding of the species and their value as a medicine, food, and commercial resource. Additionally,

literature from Common Indian Wild Flowers (Kehimkar I., 2000) and A Celebration of Indian Trees (Kothari A.S., 2007) was utilized, as well as reports from the Food and Agriculture Organization (FAO) and research articles published in The Hindu (2007 – 2013).

## Results

84 distinct species of trees belonging to 28 different families were classified as a result of the floristic survey that was conducted in both damaged and undisturbed parts of the park. There have also been 17 species of shrubs belonging to eight different families, 37 species of herbs belonging to 19 different families, 20 species of climbers belonging to eleven different families, three species of bamboos belonging to one family, one species of epiphyte and one species of parasite, and four species of palms belonging to one family that have been recorded from the park.

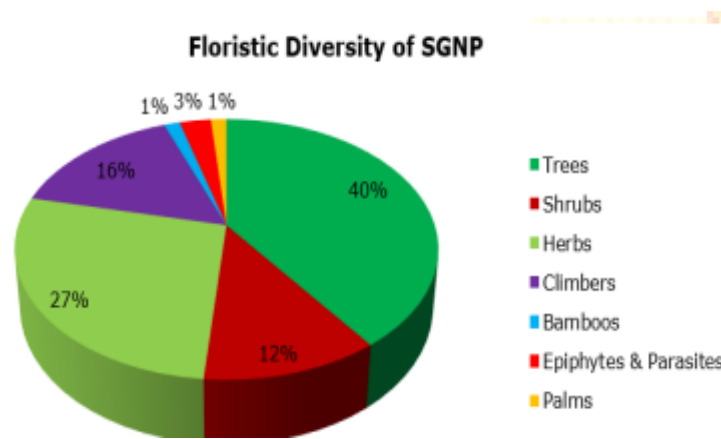


Figure 1: Differentiation of Flora by Family As Recorded by the SGNP Records

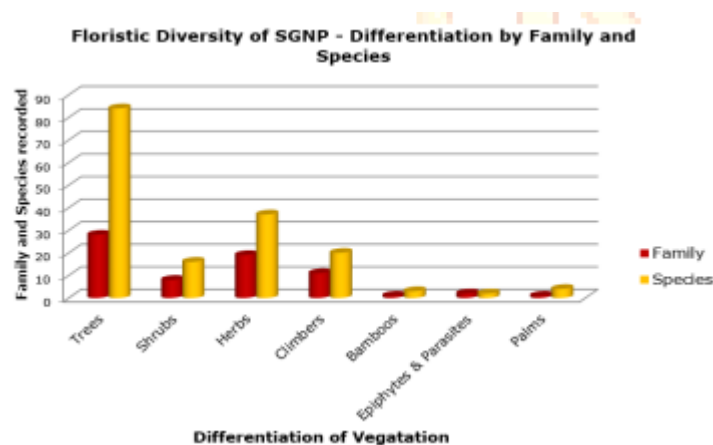
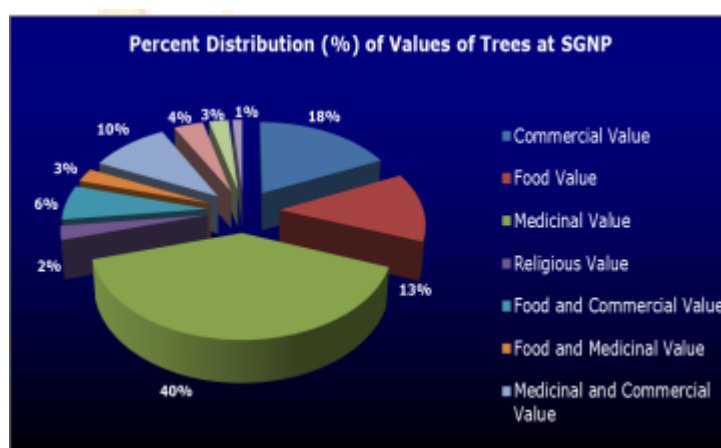


Figure 2: Differentiation of Flora Taken at the Singapore National Park based on Family and Species

## Value of Floral Diversity

The observations that were made from the recordings of trees demonstrate that out of the 84 species that belong to the 28 families, at least 81 of them are known to have an inherent value, which may be classified as either food, commercial, medicinal, religious, or all of these values. Based on the trees that have been documented, it is known that the blooms of *Nyctanthes arbor-tristis* and *Mammeasuriga* are utilized as

gifts in religious ceremonies. *Cochlospermum religiosum*, *Micheliachampaca*, and *Mitragynaparvifolia* are also known to have religious significance in addition to having economic worth. On the other hand, *Ixorabrachiata* and *Aeglemarmelos* are recognized to have both religious and medical significance. Taking into consideration the values of these trees, it is known that six of the eighty-four species of trees that have been reported are either endangered, vulnerable, uncommon, or indigenous to the region. *Flacourtiamontana* and *Syzygiumcumini* are critically endangered and extremely uncommon, in contrast to the indigenous species *Garciniaindica* and *Atalantiaracemosa*, which are recognized to be native to the area. In addition, it is well-known that *Ixorabrachiata* is listed as an endangered species, and *Miliusatomentosa* is considered to be an endemic species that is both endangered and vulnerable. Figure 3 is a graphical depiction that provides a percentage distribution of the trees that were documented in the SGNP as possible sources of food, commercial products, or medicinal substances.



**Figure 3: Distribution of trees that do not only have economic and medical advantages but also are utilized for culinary purposes**

Forty percent of the total species of trees that have been documented have some kind of medicinal use. *Miliusatomentosa*, an indigenous, endangered, and fragile species that may be found in the park's territory, is known to possess antibacterial qualities. *Terminaliachebula*, on the other hand, is known to possess properties that can cure blindness and block the formation of malignant tumors. In the treatment of diabetes, the traditional medicine known as *Bauhinia racemosa* is utilized. On account of its antibacterial qualities, *Syzygiumcumini*, which is classified as endangered and uncommon, is well-known for its therapeutic capabilities, which include the ability to treat tooth and gum diseases, diabetes, diarrhea, and ringworm.

Additionally, thirteen percent of the trees are recognized as being economically significant, given that they provide a source of food and generate substantial returns on investment. There are two types of trees that belong to the family *Anacardiaceae* that can be found in the park. These trees are *Anacardiumoccidentale* and *Mangiferaindica*, and they are the ones that are recognized across the country for their extremely expensive fruits. In a similar vein, *Annona reticulate* and *Annonasquamosa* are likewise well-known for the high prices of their fruit. Not only is *Annonasquamosa* valuable as a food source, but it is also thought to possess therapeutic characteristics, as evidenced by the fact that its bark, leaves, and roots are utilized in traditional medicine. For the purpose of imparting taste, the fruits of the *Tamarindusindica* plant are utilized in Indian cuisine. Despite the fact that certain trees do not have a high



commercial value for their produce as food, the fruits and other parts of these trees are used as food by the locals, which helps to support and satisfy their victuals. For instance, the fruits, young pods, and leaves of the *Sesbaniagrاندiflora* tree are consumed as vegetables in Southeast Asia.

## Conclusion

As a result of this ecological study of pteridophytes in Sanjay Gandhi National Park (SGNP), Mumbai, the park's remarkable variety of these ancient plants has been emphasized, as has the ecological significance of these species within this urban biodiversity hotspot. According to the findings of the study, there is a broad variety of pteridophyte species that can be found in the park's many habitats. These species exhibit a large diversity and specific distribution patterns that are impacted by the features of the habitat and the microclimatic conditions. There is a significant diversity of pteridophytes that may be found in SGNP, and the species richness is connected to the complexity of the ecosystem. The diversity of pteridophytes was especially abundant in bamboo groves, semi-evergreen forests, and moist deciduous woods because of their conditions. Particular ecological characteristics, such as the amount of moisture in the soil, the amount of shade, and the conditions of the microhabitat, are intimately connected to the distribution of pteridophyte species within the park. The concentration of pteridophytes was found to be higher in regions that had higher humidity and surroundings that were shaded. The findings of this study provide essential baseline data that may be used to drive future conservation and management plans with the goal of maintaining the distinctive pteridophyte flora of the SGNP. Especially in urban ecosystems, where such biodiversity is frequently threatened by human activities, the findings underline the necessity of specific conservation methods to maintain these plants and their habitats. These tactics are particularly important in urban environments. At the end of the day, the ecological evaluation of pteridophytes in SGNP has proved the park's worth as a repository of biodiversity in the middle of the metropolitan environment of Mumbai. It highlights the significance of ongoing research and conservation efforts to protect the biological integrity of this urban sanctuary. This will ensure that the diversified flora, which includes pteridophytes, will be able to flourish for future generations.

## References

1. Almeida MR & Chaturvedi N, Flora of Maharashtra, Blatter Herbarium, 1996.
2. Almeida MR, Flora of Maharashtra IIIA – VA, Orient Press, Mumbai, 2001 – 2009.
3. Almeida MR, Flora of Maharashtra, Bombay Natural History Society, 2009.
4. Cooke T, The Flora of the Presidency of Bombay, Volume I and II, Published under the Authority of the Secretary of State for India in Council, 1901 – 1908.
5. FAO, The status of forests: The Global Forest Resources Assessment 2000, Key Issues in the Forest Sector Today, Part II, 2000.
6. Kehimkar I, Common Indian Wild Flowers, Mumbai: Bombay Natural History Society, 2000.
7. Kothari A, A Celebration of Indian Trees, Mumbai: National Society of the friends of the Trees in association with Marg Publications, 2007.
8. Kothari A & Pathak N, Communities in conservation – Traditions to the rescue, The Hindu: Survey of the Environment, 2009, 77 – 79, 81 – 88.
9. Pradhan SG, The Flora of Sanjay Gandhi national park, Borivali, Mumbai, Botanical Survey of India, Calcutta, 2005.